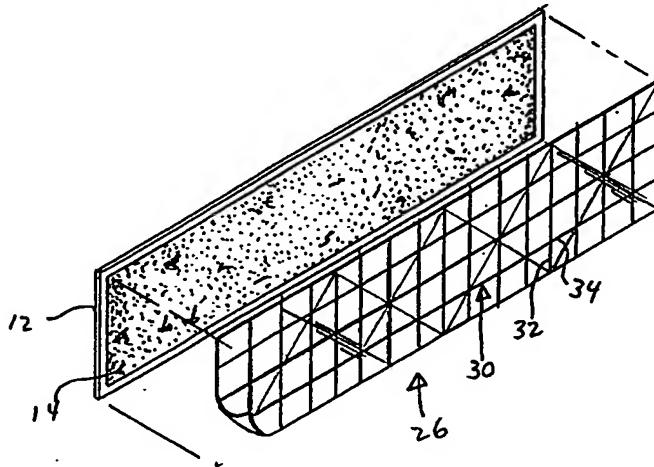




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(54) Title: INSECT TRAP



(57) Abstract

The data acquisition film medium (26) is a gridwork of lines (30) applied to read the distribution and population of insects captured on sticky material (14) on a substrate. The data acquisition gridwork of lines (30) may be applied to the substrate under the sticky material (14) or may be applied to a separate transparent data acquisition film (26) which is applied over the sticky material (14) and insects captured thereon after use of the substrate with its sticky material (14). The separate transparent data acquisition medium (26) may be in panels to cover the sticky material (14) on capture glueboards (12), on either one side or both sides of the glueboard (12), may be in bag (80) form for receiving the glueboards (12), may be on a roll (68) with tear-off edge, may be wrapped around a single-sided or double-sided glueboard (12), or may be a long length of film (26) to apply onto a long length of substrate carrying sticky material (14) in an advancing manner in an insect light trap (10). The gridwork of lines (30) aids the observer in acquiring data therefrom by helping count the captured insect population by numbers and species.

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INSECT TRAP

5 This invention is directed to a data acquisition apparatus and system by which particular flying insects attracted to a flying insect light trap are retained for identification and counting. In one embodiment there is disclosed a data acquisition apparatus and system for flying insect light traps.

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BACKGROUND OF THE INVENTION

Over the years a number of flying insect traps have come into use. Insects are attracted to the traps by various attractants such as color, light and/or scent. The attracted insects are 15 then captured and/or killed by various means. Various traps have used systems of baffles, fans, insecticides, glueboards, glue films, electrocution, heat lamps and liquids. Such traps did not provide a convenient means for identification of various insects, counting the total number of insects and determining the different 20 kinds of insects within the total count and the number of insects of each kind.

While the production of food for human consumption in the United States has been regulated and has been considered quite safe, modern methods of hazard analysis are becoming applied to the 25 production of food. The present effort at hazard analysis includes its commitment to "science-based decision making" that will improve

food safety.

Pest control is a crucial component in the prevention of microbiological contamination. The hazard analysis quality standards and requirements for monitoring and record-keeping will 5 enter the field of flying insect contamination and will affect pest management strategy. It is expected that food processing organizations will find their operations subject to monitoring and record-keeping. It is expected to be necessary to document infestation levels with insect catch counts to verify that critical levels are 10 not being exceeded. Species-specific monitoring of insect contamination is expected to be required to permit pest management strategies to be most effective in limiting food contamination during the production, processing and storage activities.

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SUMMARY OF THE INVENTION

In order to aid in the understanding of this invention, it can be stated in essentially summary form that it is directed to a counting grid of rows and columns used in association with a 20 glueboard or glue film to facilitate tallying the number and types of flying insects captured on the glueboard or film in a flying insect light trap.

It is thus a purpose and advantage of this invention to provide an improved flying insect capture medium for use with a 25 flying insect light trap so that the light trap not only captures the insects but the improved capture medium facilitates the

monitoring, capture rate determination, tallying and record-keeping of the flying insect catches.

It is a further purpose and advantage of this invention to provide an economic means whereby present day insect light traps can be employed to catch insects and the data medium used therewith preserves the state and concentration of insects so that, at a later time, they may be tallied.

It is a further purpose and advantage of this invention to provide economic means by which data can be acquired with respect to the numbers and types of insects which are trapped by an insect light trap.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further purposes and advantages thereof, may be understood best by reference to the following description, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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FIGURE 1 is an isometric view, partly broken away, of an insect light trap which utilizes a glueboard for use with a data acquisition medium of this invention.

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FIGURE 2 is an isometric view of the glueboard as used in the trap of FIGURE 1, shown with captured insects and removed from the trap, with an exploded isometric view of a preferred embodiment

of the data acquisition medium in accordance with this invention about to be applied to the glueboard.

FIGURE 3 is a schematic plan view of the glueboard with the data acquisition medium of FIGURE 2 attached thereto.

5 FIGURE 4 is an enlarged section as seen generally along line 4-4 of FIGURE 3, with parts broken away, showing a double-sided glueboard with data acquisition media on both sides.

FIGURE 5 is a plan view of another preferred embodiment of this invention.

10 FIGURE 6 is a schematic end view of a second version of a flying insect light trap, showing data acquisition film media used therein in accordance with this invention.

FIGURE 7 is an isometric view of a data acquisition film medium in accordance with this invention.

15 FIGURE 8 is an exploded isometric view of a double-sided glueboard with another preferred embodiment of a data acquisition film medium in accordance with this invention.

20 FIGURE 9 is an enlarged plan view of the glueboard and data acquisition film medium of FIGURE 8, partly broken away and sectioned.

FIGURE 10 is a further enlarged sectional view taken generally along line 10-10 of FIGURE 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A flying insect light trap of conventional design is indicated generally at 10 in FIGURE 1. It contains therein a board 12 which, for example, is of generally rectangular configuration and is coated on preferably both sides with sticky material. FIGURES 1, 2 and 3 show the sticky material 14 on only the front side of the board 12, while FIGURE 4 shows the double-sided board with sticky material 16 on the rear side. The board 12 is self-supporting material, such as cardboard. The sticky material is suitable for capturing flying insects when they land on it. The board 12 is thus considered a glueboard. Light trap 10 has a lid 18 which, when opened, permits the glueboard to be removed and replaced. The insect light trap 10 has means for attracting insects, such as incandescent or fluorescent light tubes 20. The light tubes generally are coated with an ultra-violet (UV) coating which preferably causes emission of light in the UVA band at about 365 nanometers wavelength, generally known for maximized attraction of flying insects. Non-UV light can be used when reliance on phototropic effects is justified. When the glueboard is one-sided, i.e., has sticky material 14 on only the front side, the light tubes 20 need be only in the front portion of the trap. The housing of the insect light trap has a series of front slots 22 which form a grilled opening to permit the entrance of flying insects so that they have access to the front side of the glueboard 12. The front, sticky side of the glueboard faces the front slots 22. When the glueboard is double-sided, rear lights 24 may be used,

and rear slots (not shown) similar to the front slots 22 form a grilled opening for access to the rear side of the glueboard 12. The slots are designed for maximum access by the insects and minimum view of the glueboard by persons in the vicinity. This latter feature is to protect the sensibilities of those near the trap, so they have a minimized view of the captured insects, although there are many differently configured insect light traps which can employ glueboards for use in the system of this invention. In addition to light, other means such as odor and/or color can be employed to attract the insects to the trap and to the glueboard. FIGURE 2 shows the glueboard with a plurality of insects captured thereon. For convenience of illustration, only a few insects are indicated although, in practice, large numbers of insects may be trapped from time to time.

The data acquisition film medium of this invention is indicated generally at 26 in FIGURES 2 and 3. It comprises transparent flexible film material 28, which is transparent synthetic polymer composition material. The material may be of the self-clinging type, such as Saran-Wrap. The medium 26 has a grid 30 marked thereon. The grid is preferably formed of regularly spaced vertical lines 32 and regularly spaced horizontal lines 34. The spacing is preferably the same to define squares. The medium 26 is sized so that it covers the sticky material 14 on the board 12. Thus, after the glueboard 12 has been utilized to capture flying insects, it is removed from the light trap 10. Thereupon, the data acquisition film medium 26 is placed over the sticky side.

The application of the film medium 26 over the glueboard accomplishes several functions. Firstly, it prevents the insects from falling off the glueboard to contaminate the surroundings. By preventing the falling off of insects, it maintains basic information because the user can be assured that all of the insects have been retained thereon for counting. The placement of the film medium over the glueboard prevents contamination of the handler from the glue and also maintains the insect capture status of the glueboard so that the status is the same as when the film medium was placed thereon. Thus, later insect accumulation is not a possibility, since such occurrence would reduce the accuracy of the data acquired. Placement of the transparent film thus maintains the status of the insect distribution and concentration on the glueboard. In addition, the grid 30 aids in the counting of the captured insects both in numbers and species. Each grid area can be counted individually and accuracy is enhanced. On the other hand, should insects be fairly evenly distributed on the glueboard, only a representative number of grid squares need be counted and an appropriate multiplier be used to estimate the total number of insects captured. The multiplier is the result of the total number of grid squares divided by the number of counted grid squares. Thus, the film medium is data acquisition apparatus to obtain aid in counting the number and types of flying insects caught in the light trap.

As seen in FIGURE 4, the board 12 is coated with sticky material on both sides, with sticky material 14 and 16 shown on the

front and rear, respectively, of the board 12. Insects such as at 36 are caught on the sticky capture material on the front of the glueboard and insects such as at 38 are caught on the sticky capture material on the back side of the glueboard. Thereupon, the 5 glueboard is removed from the trap and replaced with a new glueboard. At this point, the data acquisition film medium 26 is placed over the insects and the sticky capture material on the front side of the board, and data acquisition film medium 40 is placed over the insects and the sticky capture material on the rear side of the board. The data acquisition film mediums 26 and 40 are 10 the same. In this double-sided glueboard case, the film mediums 26 and 40 may consist of a single piece, folded over onto both sides of the board. After application of the mediums, the glueboard 12 is safe for handling, counting insects and storage for 15 later evaluation.

The board 42 shown in FIGURE 5 is sized to fit into a suitable insect light trap. It may be single-sided or double-sided depending upon the character of the insect light trap in which it will be used. Presuming it is double-sided, the other side will be 20 the same as the visible side, which is described below. A printed counting grid 44 is applied to the board before the application of sticky material 46. The sticky material is sufficiently transparent so that the printed grid can be seen therethrough. This relationship is demonstrated in FIGURE 5 by showing sticky material 25 46 on only a portion of the glueboard 42, with the printed grid 44 appearing in slightly lighter lines under the sticky material 46.

After the board 42 is used in a flying insect light trap, it is removed and can immediately be read so that the captured insect population can be analyzed for numbers of species. If desired, a layer of clear protective material can be overlaid on the sticky material before or after the data is taken. The lower band 48 is a separate layer of paper attached by perforation line 50. The data with respect to date, time, captured insect population numbers and species may be entered onto the lower band 48. The lower band is then removed for safe-keeping and the board 42 thereupon may be discarded. This saves storage space. If the board 42 is double-sided, a similar lower band is provided thereupon for data taken from that other side of the board.

The data accumulation apparatus thus far described has been in association with an insect light trap of the nature of trap 10, or a double-sided version thereof. Insect light trap 52 shown in FIGURE 6 does not rely upon the fixed and periodically changed insect capture board. Instead, it has a supply roll 54 of flexible substrate material 56 which carries sticky material 58 on the front face thereof. The right side of the housing is open for the entry of flying insects and has insect attracting equipment therein, such as ultra-violet lights. The insects are captured on the sticky material in the same way as described above. The difference with insect trap 52 is that drive means 60 advances the flexible substrate material 56. It may be continuously advanced at a slow rate or, more commonly, may be periodically advanced to expose a new area of sticky material. The already exposed flexible

substrate is wound up on takeup roll 62. Data entry device 64 may apply marks to the flexible substrate material 56 so that each exposed panel can be separately identified as to date, time, length of exposure and other kinds of relevant data. In order to permit 5 data to be acquired and the insects preserved in accordance with the present invention, the data acquisition film medium 66 is provided on roll 68 (see FIGURE 7). The roll 68 is mounted in the flying insect light trap 52 to roll onto and cover the sticky material and the insects captured thereon. The data acquisition 10 film medium 66 is a long strip of transparent material, such as synthetic polymer composition material transparent film. As seen in FIGURE 7, it has a grid 70 thereon, preferably by printing, so that when it is applied over the captured insects on the sticky material, the same effects are achieved as described above in 15 connection with the glueboard versions. Thus, the insect population with respect to quantity and type can be observed and data taken after the supply roll 54 is exhausted and the take-up roll 62 is removed from the trap. The used flexible substrate material 56 with its data acquisition film 66 thereon can be wound for storage 20 and unwound for data-taking. Since the sticky material is covered with the data acquisition film medium 66, the used sticky-coated flexible substrate material can be safely handled without engaging the insects or the sticky material. In this way, data can be acquired and the material stored for later analysis.

25 In addition to the above-described embodiment of the present invention, FIGURES 6 and 7 are used conveniently to

illustrate another embodiment which is a double-sided version. When so used, the flexible substrate material 56 carries sticky material 72 on the rear face thereof so that flying insects can be captured on both front and rear faces, such captured insects being shown diagrammatically at 74 and 76, for instance. Another roll 78 of flexible transparent film material is used to cover the rear face and secure the captured insects as previously described. When the roll 68 bears a grid, such as grid 70, roll 78 is clear and gridless; if desired, the grid function can be interchanged between rolls 68 and 78. In this double-sided version, the flexible substrate material 56 is transparent so that the data analysis can be performed from either the front or rear when the takeup roll 62 later is unrolled. It should be noted that the flexible substrate material 56 may be either transparent or opaque when used in the single-sided version.

Referring to FIGURES 8, 9 and 10, there is seen the double-sided glueboard 12 previously described in connection with FIGURES 1-4. In this version of the data acquisition apparatus of this invention, there is provided a bag 80 of substantially transparent synthetic polymer composition material having a plurality of grid lines thereon. The horizontal grid lines, such as grid line 82, and the vertical grid lines, such as grid line 84, appear on both sides of the bag. For convenience of manufacture, both the horizontal and vertical grid lines may be printed in a continuous manner on the bag material before the bag material (normally on rolls) is placed into the conventional bag-making

machinery. When finished, the bag 80 is provided with a closed bottom end 86, an open top end 88, a plastic zipper 90 for closing off the main body of the bag, and a data-receiving panel 92 at the upper end for the writing or otherwise imprinting of the desired data such as, initially, the date, time and site of board exposure and retrieval. Later, the insect types and numbers can be recorded on panel 92. The board 12, bearing the captured insects thereon, is inserted through the top end 88 of the bag until it rests on the bottom end 86 of the bag. It should be noted that the size of the bag preferably is related to the size of the glueboard 12. For instance, the main portion of the bag, i.e., the portion of the bag between the bottom end and the zipper, should approximate the length of the glueboard 12. Similarly, the width of the bag should approximate the width of the glueboard, noting, however, that the inside dimensions of the bag should be sufficiently greater than the outside dimensions of the glueboard with its adhered insects so that the insects are neither damaged nor displaced during the insertion of the glueboard into the bag. Once the glueboard has been inserted, it is preferred to lightly press the bag material against the sticky material, thereby assuring the retention of the captured insects on their capture sites on the glueboard. Then, the zipper is sealed and the data acquisition apparatus is complete.

This invention has been described in its presently contemplated best modes and embodiments and it is clear that it is susceptible to numerous modifications, modes and embodiments within the ability of those skilled in the art and without the exercise of

the inventive faculty. Accordingly, the scope of this invention is defined by the scope of the following claims.

WHAT IS CLAIMED IS:

1. A data acquisition apparatus comprising:

a substantially transparent synthetic polymer composition material film medium having a plurality of grid lines thereon, a first group of said grid lines being spaced from each other and a second group of said grid lines angularly related to said first group of said grid lines, said film medium being sized to overlay the sticky material on an insect trap substrate so that, after use of the insect trap substrate with insects captured in the sticky material, said film medium can overlay the sticky material to cover the sticky material and retain the insects captured therein so that said grid lines can aid in observing and counting the type and numbers of insects captured in the sticky material.

2. The data acquisition apparatus of Claim 1

wherein said substrate is a board of limited flexibility.

3. The data acquisition apparatus of Claim 2

wherein there is sticky material on both sides of the board and there is a substantially transparent film medium with grid thereon overlying both of the sticky materials.

4. The data acquisition apparatus of Claim 2 wherein said film medium is in the form of a bag having a sealable opening for receiving said substrate after use, said bag encompassing said substrate.

5. The data acquisition apparatus of Claim 3 wherein said film medium is in the form of a bag having a sealable opening for receiving said substrate after use, said bag encompassing said substrate.

6. A data acquisition apparatus comprising:
a board sized to be placed into a flying insect light trap;
visible grid lines on said board; and
sticky material on said board and over said grid lines, said sticky material being sufficiently sticky to capture flying insects and being sufficiently transparent to permit

1 seeing of said grid lines so that, after said board is exposed to
2 flying insects so that insects are captured in said sticky
3 material, data relating to numbers and species of insects can be
4 taken by observing insects with respect to the grid lines.

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1 7. The data acquisition apparatus of Claim 6
2 further including a flexible sheet of transparent synthetic polymer
3 composition material sized to overlay said sticky material after
4 insects are captured thereon to prevent gain or loss of insects to
5 preserve the data.

6

1 8. A data acquisition apparatus comprising:
2 an elongated substantially transparent flexible
3 film medium with visible grid thereon, said film medium having a
4 transverse direction, said film medium being as wide in said
5 transverse direction as the flexible substrate carrying sticky
6 material in a flying insect light trap that has substrate material
7 advancing from a supply roll to a takeup roll with exposure to
8 flying insects therebetween so that sticky material thereon can
9 capture flying insects, said transparent flexible film medium with
10 grid being attached to the sticky material before the flexible
11 substrate material is wound up on the takeup roll so that said
12 flexible substantially transparent film medium with grid is wound
13 onto the sticky face of the flexible substrate material as it goes
14 onto the takeup roll so that the takeup roll can be subsequently
15 unrolled to acquire data related to the captured insect population
16 by reference to said grid.

1 9. The data acquisition apparatus of Claim 8
2 wherein said flexible substrate is transparent and has said sticky
3 material on both sides thereof to capture flying insects, and
4 further including a second elongated transpar-
5 ent flexible film medium for being attached to the other sticky
6 material side so that said second film medium is wound onto the
7 other sticky face of the flexible substrate material as it goes
8 onto the takeup roll.

1 10. The data acquisition apparatus of Claim 8
2 further including means for applying time and/or date data to said
3 flexible substantially transparent film medium so that said time
4 and/or date data is available for acquisition when said takeup roll
5 is unrolled for the visual acquisition of captured insect data
6 therefrom.

1 11. The data acquisition apparatus of Claim 1, 6 or 8
2 wherein said grid comprises a/said first group of grid lines which
3 are straight, parallel and equally spaced.

1 12. The data acquisition apparatus of Claim 11
2 wherein said grid comprises a/said second group of grid lines which
3 are straight, parallel and equally spaced.

1 13. The data acquisition apparatus of Claim 12
2 wherein said first group of said grid lines and said second group
3 of said grid lines are comprised of grid lines which are positioned
4 substantially at a right angle with respect to each other.
5

14. The data acquisition apparatus of Claim 12
wherein there is a said grid and said sticky material on both
sides of said board.

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15. The method of acquiring data with respect to
1 flying insect population comprising the steps of:

2 exposing a substrate having sticky material on
3 one face thereof to flying insects and attracting flying insects to
4 the sticky material so that the insects are captured thereon;

5 after completion of capture of insects on the
6 sticky material, covering the sticky material with a transparent
7 film medium with a visible grid thereon to prevent the capture of
8 more insects and prevent the loss of insects already captured; and

9 taking insect population data by observing the
10 captured insects through the transparent film medium with grid
11 thereon so that the visible grid enhances ease and accuracy of
12 counting insects and identifying their species.

16. The method of Claim 15 wherein the transparent
1 film medium with grid thereon is provided with a rectangular grid.

FIG 4

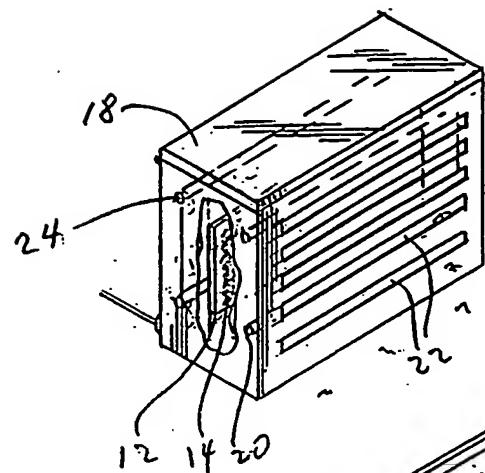


FIG 2

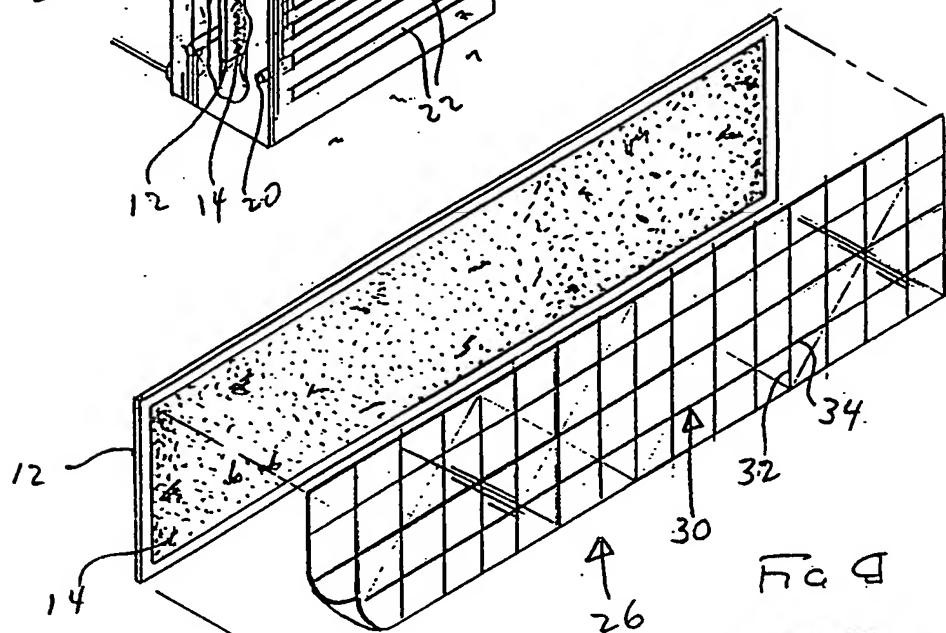


FIG 4

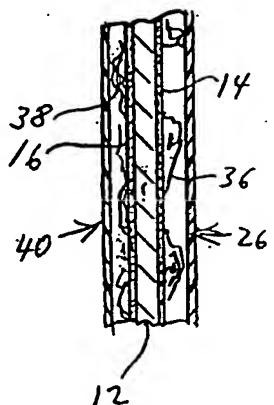
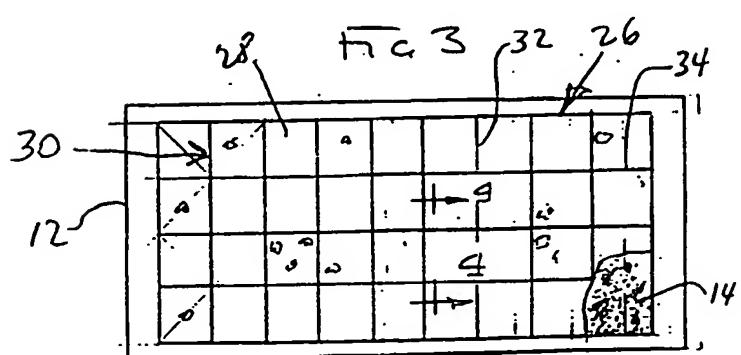


FIG. 5

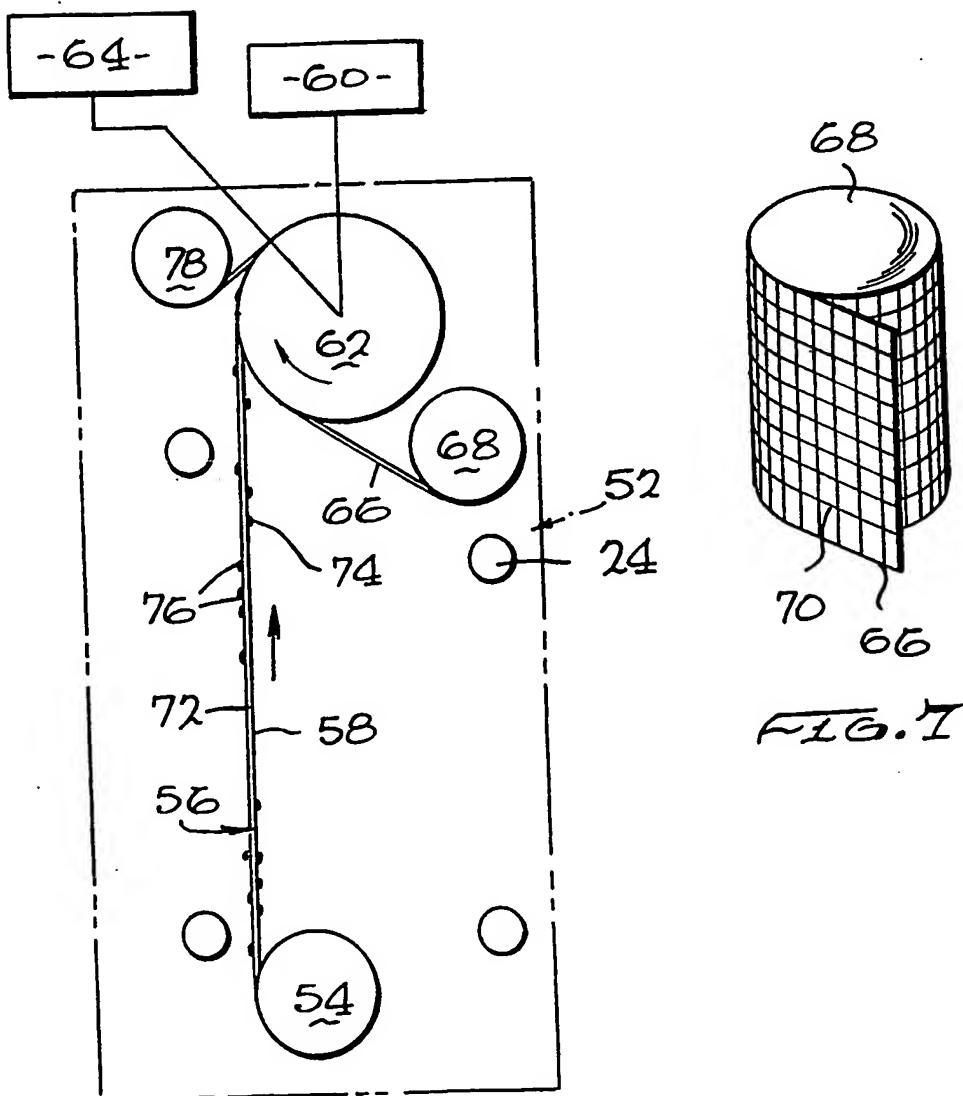
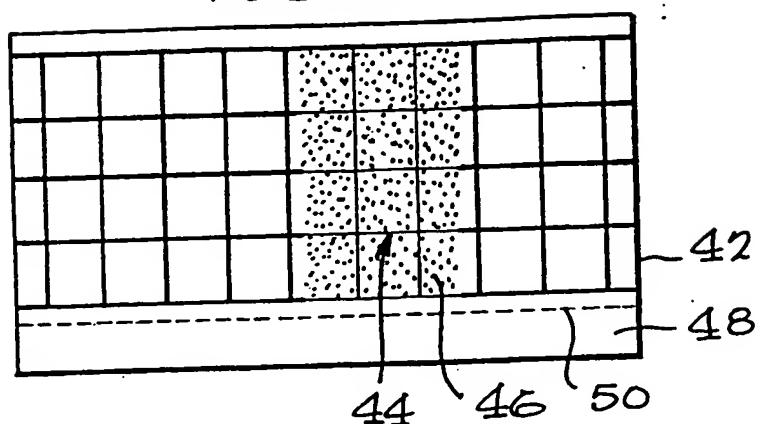
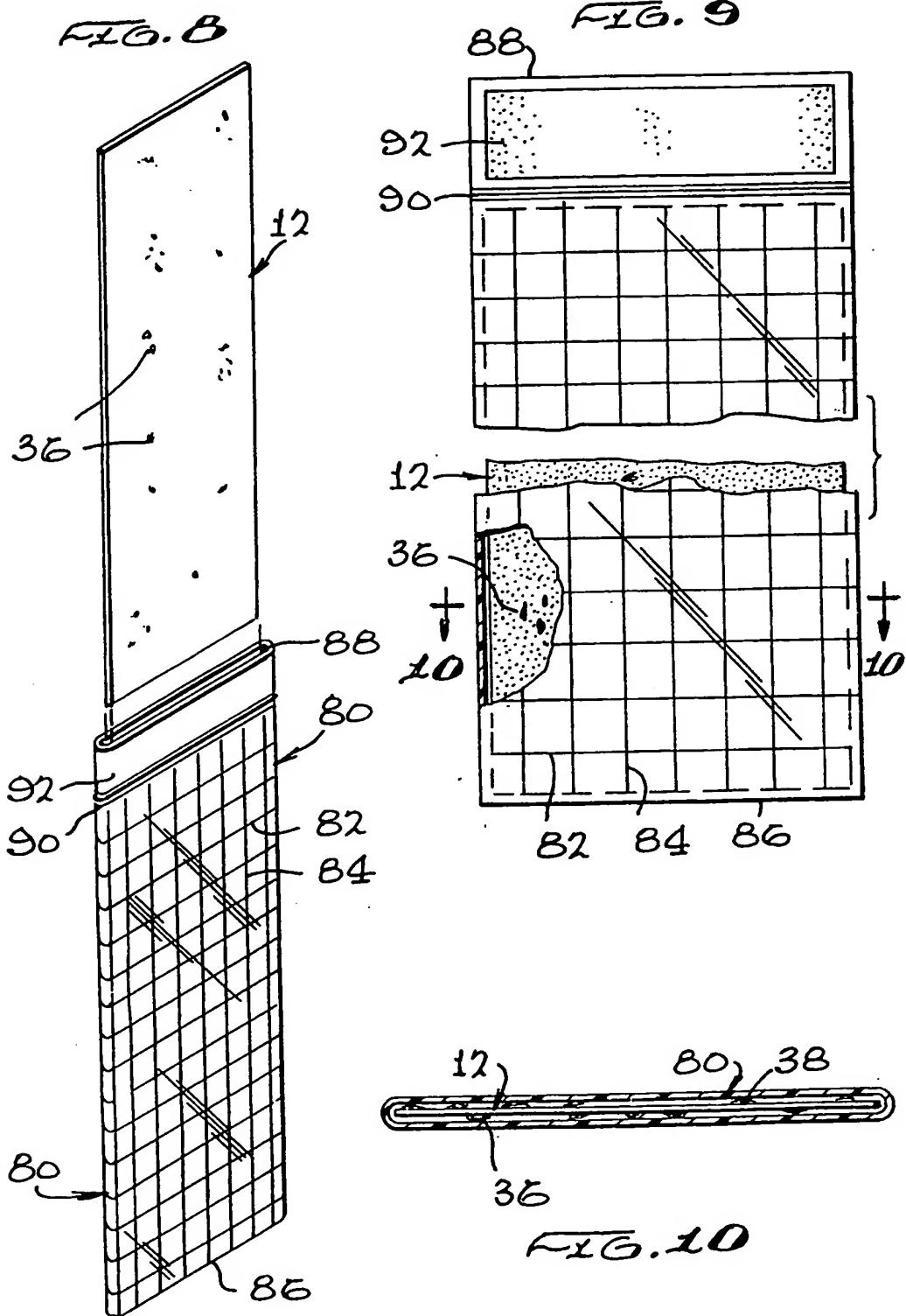


FIG. 7

FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/07987

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A01M 1/14

US CL :43/114-118, 136; 422/343; 40/661, 361; 434/324; 353/45

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 43/114-118, 136; 422/343; 40/661, 361; 434/324; 353/45

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,867,731 A (WILLARD ET AL) 19 September 1989 (19.09.89), whole document.	6-7
A	US 5,353,542 A (VAUDRY) 11 October 1994 (11.10.94), whole document.	1-15
A	US 836,634 A (CORBETT) 20 November 1906 (20.11.06), whole document.	1-15
A	US 5,425,197 A (SMITH) 20 June 1995 (20.06.95), whole document.	1-15
A	US 4,425,733 A (AMMON ET AL.) 17 January 1984 (17.01.84), whole document.	1-15

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Date of the actual completion of the international search

25 JUNE 1999

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,628,142 A (KITTERMAN ET AL.) 13 May 1997 (13.05.97), whole document.	1-15
A	US 5,577,342 A (JOHNSON ET AL.) 26 November 1996 (26.11.96), whole document.	1-15
A	US 4,829, 702 A (SILVANDERSSON) 16 May 1989 (16.05.89), whole document.	1-15

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